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**Title:**  
**Improvements in and relating to flushing tanks**

**Abstract:**

497,765. Valve-discharge water-wastepreventers. KJAERSGAARD, M. A. June 28, 1937, No. 17966. Convention date, June 27, 1936. [Class 26] In a water-waste-preventer in which a valve returns to its closing- position under the action of gravity or a spring or both and against a resistance ceasing after a predetermined time, the quantity of the discharge is varied by moving the valve predetermined distances from its closing- position. The valve 7 can be moved in a cylinder 5 from a position in which it seats upon the cistern-outlet 4

by one arm 17 of a double-armed lever ; the other arm 18 of the lever is connected to chains 19 fitted with stops 20 coacting with a slotted member 21, whereby the arm 17 and therefore the valve may be moved to the extent required. The descent of the valve is opposed by the partial vacuum which tends to form in the cylinder above it, the amount of such vacuum being controlled by a preferably adjustable aperture 22, or by the fit of the valve in its cylinder or of a one-way closure-valve 11 in the upper part of the cylinder.

An aperture 23 in the cylinder-wall serves to break the vacuum after the valve has travelled a certain distance, while apertures 8 in the lower part of the cylinder place the cistern and outlet in communication. The cistern is filled at 12, air escaping by a pipe 13 until the latter is closed by a pivoted float 14, whereafter the supply continues until the pressure in the mains and the cistern become equal.

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## PATENT SPECIFICATION



Convention Date (Denmark): June 27, 1936.

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### COMPLETE SPECIFICATION

#### Improvements in and relating to Flushing Tanks

1, MARINUS ALFRED KJÆRSGAARD, of No. 36, Rentemestervej, Copenhagen, Denmark, a subject of the King of Denmark, do hereby declare the nature of 5 this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

This invention relates to a flushing tank 10 for water-closets or the like and has for its object to produce a particularly simple and efficient construction of such tanks, whereby it is made possible amongst others to draw off variable quantities of water 15 from the tank, according to wish.

The tank according to the invention is of the kind where a valve, when it has been removed from its closing position so as to allow the discharge of water from 20 the tank, will again move back to the said position, e.g. by gravity or by spring pressure, but is counter-acted by a resistance ceasing automatically after a predetermined time, and the invention is 25 characterised by the fact that the valve is directly affected by mechanical means adapted to remove it predetermined distances from its closing position, so that the time necessary to close again the valve, 30 and therewith also the quantity of discharged water, may be varied in a predetermined manner.

The valve may e.g. be under influence of a single lever adapted to cause variable 35 displacements of the valve away from its closing position, e.g. by means of various chains or the like with differently limited movements, or the valve may be effected by two or more levers, the movements of 40 which are differently limited, e.g. by means of suitable stops, corresponding to different quantities of flushing water.

According to a further construction of 45 the invention the valve is preferably displaceable in a cylinder, so that when being removed from its closing position it forces air or liquid out from the said cylinder or from a space communicating therewith, and the construction may be so that water 50 can be again supplied to the said space or to the cylinder only through inlets yielding a considerable resistance to the passage of the water, so that during the

endeavour of the valve to return to its closing position (owing to gravity or spring pressure) a higher or lesser vacuum will occur, which retards the return of the valve in a degree which depends on the value of the resistance to the passing of the liquid through the said passages. 55 60

The tank may preferably be directly connected with a water conduit under pressure, so that its contents of water are always under the pressure existing in the said conduit. The tank may be so constructed that an air space remains in its top portion, the supply of water ceasing, when a float valve has closed an air supply aperture and the air has been so compressed that its pressure corresponds to the water pressure. When thereupon the tank is emptied, and the water level sinks, the float valve uncovers at a certain moment the air supply aperture, so that the last part of the flushing can take place by means of the free height of the fall of water. 70 75

The invention is illustrated in the accompanying drawing, which shows a constructional form of a tank according to the invention in vertical section. 80

1 is the tank proper, which is at its bottom connected, by means of an intermediate part 2, with a conical tube 3, which may be connected at its lower end with a flushing tube (not shown) leading to the closet basin. The intermediate part 2 has a central opening 4, above which is a cylinder 5, between which and the intermediate part 2 a packing 6 is inserted. In the cylinder 5 a valve 7 is vertically displaceable, which bears tightly in its lowermost position, as represented in the drawing, against the packing 6 and closes in this position also openings 8 through 95 the bottom part of the wall of the cylinder, a suitable number of such openings being distributed along the circumference of the cylinder. The top end or cover 9 of the cylinder has an opening 10, 100 which is normally closed by a counter-valve or flap 11.

At the top of the tank a tube or socket 12 is shown, which communicates with a pressure water conduit, and a tube or 105 socket 13, through which air may pass in

and out to and from the tank. 14 is a float closing the air socket 13, when the water level in the tank has reached the line 15.

5 Under the intermediate part 2 a two-armed lever 17, 18 is mounted on a pivot 16, one arm 17 being intended to coact with the valve 7, while the other 18 is intended to be influenced by means of chains 19. These chains 19 may be provided with suitable stops; e.g. rubber pieces 20, which coact e.g. with rails 21 allowing the chains to pass, but stopping the stops 20 so as to limit the downward movement of the lever 18.

The tank according to the illustrated constructional form acts as follows:—

In the position of its varicus parts represented in the drawing the tank is in 20 its normal condition, in which the valve 7 assumes its closing position and the tank is filled with water to the level of the line 15, while the space above this line is filled with compressed air. When a flushing 25 has to take place, the arm 18 is pulled down by means of one or the other of the chains 19, whereby the arm 17 is swung up and pushes the valve 7 up in the cylinder to a height depending on the 30 co-operation between the rails 21 and one or the other of the stops 20. The upward movement of the valve 7 uncovers the openings 8 of the cylinder 5, so that discharge of water from the tank through 35 the aperture 4 can take place. The discharge takes place at once with great force, as the water in the tank is at first under the pressure prevailing in the pressure conduit.

40 The upward movement of the valve 7 forces the water above the same, or part of the water, out from the cylinder 5 into the tank through the aperture 10 and counter-valve 11. As soon as the influence 45 upon the valve 7 from the arm 17 ceases (when the chain has been released), the valve will, owing to its weight (contingently supplemented by spring force), tend back to its closing position, but this 50 will produce a vacuum above the valve 7, the counter-valve 11 closing as soon as the increased pressure in the space above the valve ceases. If this vacuum was allowed to continue, it would prevent 55 closing of the valve 7, 8, so that the discharge would continue, as fresh water is continuously supplied from the pressure conduit during the discharge. Care is, however, taken to admit water again to 60 the cylinder space above the valve 7 either by arranging that the valve 11 does not close quite tightly, or by a special valve or bore with suitably great resistance to the passage, e.g. placed as indicated by 65 22, and preferably adjustable by

arranging that the valve 7 does not fit quite tightly in the cylinder 5. The said re-entering of water into the space above the valve enables the latter to return to its closing position, and when the openings 8 have again been closed, the discharge of water from the tank ceases. The supply of water from the pressure conduit continues thereupon until the water has reached so far up (line 15) that the float closes the discharge of air from the tank through the socket 13, and the air pressure above the water has reached the same pressure as the water in the pressure conduit.

To obtain a rapid closing of the openings 8 during last part of the motion of the valve (if the latter fits tightly) a pressure-equalizing aperture may be arranged at a suitable distance from the top of the cylinder 5, as indicated by 23, so that this aperture begins to be uncovered simultaneously with the beginning of the closing of the apertures 8.

It is remarked that the presence of the air space above the water in the tank induces a mixing of the discharging water with air, which is favourable to the flushing, and that the free communication from the air space to the atmosphere through the socket 13, when the float has opened the latter, induces a good additional flushing employing the free height of fall of the water.

The invention is not limited to the above described and illustrated constructional form, which is only described by way of example to illustrate the principle of the invention. It is possible to alter within the frame of the invention the said constructional form in many ways not only as regards the valve construction but also as regards the means for actuating the valve, the construction of the tank and its connection with the pressure conduit.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

1. A flushing tank for water-closets and the like of the kind, in which a valve, when it has been removed from its closing position, so as to allow the discharge of water from the tank, will again move back to the said position, e.g. by gravity or by spring pressure, but is counter-acted by a resistance ceasing automatically after a predetermined time, characterised in that the valve is directly affected by mechanical means adapted to remove it predetermined distances from its closing position, so that the time necessary to close again the valve, and

therewith also the quantity of discharged water, may be varied in a predetermined manner.

2. A flushing tank according to claim 1 characterised in that the valve is actuated by a single lever adapted to produce variable displacements of the valve away from its closing position, e.g. by means of various chains or the like with 10 variously limited movements.

3. Tank according to claim 1 characterised in that the valve body is actuated by two or more levers, the movements of which are variously limited, e.g. by 15 means of suitable stops, corresponding to different quantities of washing water.

4. Tank according to each of claims 1—4 characterised by a valve which is displaceably mounted in a cylinder, and 20 which forces, when removed from its closing position, air or liquid out from the said cylinder or from a space communicating therewith, the construction being so that admission of water can only take 25 place again through inlets yielding a great resistance to passage, so that during the return motion of the valve a higher or lesser vacuum will be produced retarding the return motion dependent on the 30 resistance to the passage through the said inlets.

5. Tank according to claim 4 characterised in that the valve is displaceable, e.g. from the bottom upwards, in a 35 cylinder built into the tank and provided with a cover or (top) breech and communicating at its (upper) end with the interior of the tank through a counter-valve.

40 6. Tank according to claim 5 characterised in that the said counter-valve does

not close quite tightly, so that a slow re-filling can take place through it, when the valve tends back to the closing position owing to gravity or spring pressure. 45

7. Tank according to claim 4 or 5 characterised by the presence of a particular, preferably adjustable valve or bore in the (top) end of the said cylinder.

8. Tank according to claim 4 or 5 50 characterised in that the valve does not fit quite tightly in the cylinder, so that between the latter and the valve a suitable re-admission of water can take place to the space above the valve. 55

9. Tank according to claim 4, 5, 6, 7 or 8 characterised in that the said cylinder has, at a suitable distance from its end, a pressure equalizing opening, the uncovering of which during last part of the return 60 motion of the valve produces a quick termination of the said motion.

10. Tank according to any of the preceding claims and directly connected with a pressure water conduit, characterised in 65 that it is provided with a float closing, at a certain level of water in the tank, an air supply opening in the latter, so as to stop the supply of water, when the pressure in the air space in the top portion of the tank 70 has reached the water pressure, while it uncovers the said opening during the emptying of the tank, so that the initial pressure washing is followed by a washing utilizing the free height of fall of the 75 water.

Dated the 28th day of June, 1937.

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[This Drawing is a reproduction of the Original on a reduced scale.]

